Title: ARPA Network Functional Specifications

Author: G. Deloche

Installation: University of California at Los Angeles

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ARPA network: Functional specs

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I Transmission features

I-1 Transmission checking

There exists two kind of transmission checking :

* IMP to IMP

It is a cyclic checksum computed and checked by the BBN hardware

* HOST to HOST

It is a special 16 bits checksum emitted and checked by the HOST programs.

For this purpose a HOST message is broken down into 1152 bits pieces A, B, C ... (1152 = 2.24 # packet).

For each of piece, we calculate an end-around carry sum and form the checksum as follows :

Checksum = Sum of A + 2 * Sum of B + 4 * Sum of C (etc).

This 16 bits checksum is located just after the marking of the HOST heading, that is at the beginning of the message text (See fig 1)

This checking procedure allows the verification of the right IMP to IMP procedure. It also protects against HOST to IMP (or IMP to HOST) bad transmission, and against IMP packet number inversion.

Remark : Example of an end-around carry sum :

```
  101
+ 101
-----
 1010
 ↺
```

Checksum = 011

I-2 HOST(A) to HOST(B) links.

32 links are possible between two HOSTS.
Each of these links are viewed as full duplex
Link 0 is considered as a control link (request connection, states of any kind ...)
The 31 others are used either for "teletype like connections or for file transmission connections.

A "TTY like" connection is one where :
- ASCII character are sent or received.
- Echos are generated by the remote HOST
- The remote HOST looks for specific ... (break or interrupt control characters).
- The transmission is slow.

II Functional software specifications.

- See fig 2 -

II-1 User program. DEL language

Its an application program that exists within a HOST. For example the NLS program at SRI.
For network purposes this program should be viewed as parted in two: The local part and the hard part (the body).

- The hard part represents the user application.
- The local control part is the user interface. It exerts immediate control of the terminal and provides specific responses to the man's inputs.

In order to facilitate and speed up remote interac the 'local control' program can be transmitted to another Host Thanks to that capability an UCLA user, for example, will use its terminal exactly like the SRI user uses his own. Also only the program data are transmitted over the link (versus the user terminal dialogue) - See f

DEL language. (Decode Encode Language)

The "local control" program should be written in the DEL language - when it is transmitted over to a remote

II-2 Network program

This program should provide :
- The outgoing messages multiplexing (and incoming messages distributing)
- The link initiation procedure : see below.
- The HOST message Heading.
- The "HOST-HOST" checksum computation/checking.
- The receiving of the RFNM control messages.
- The supervisory control of the Handler program.

II-3 Transmission Handler program

This program is initiated either by the network program, or by the I/O interrupt. Its purpose is to control the channel hardware unit.

This program is very short and closely related to the Network program.

Remark : As the communication is full duplex the Network and Handler programs can be viewed as divided into 2 parts : one is concerned with the outgoing messages, the other with the incoming messages.

III Link establishment procedure

1. III-1 General procedure

* Establish link to HOST (x)-
A "TTY like" connection is established to HOST(x). connection is in a pre-log-in state. Standard TTY c are expected. The remote HOST provides the echo.

* Send/Receive characters over "TTY like" link.

* Establish file transmission link parallel to existing "TTY like" link. This must be executed b both HOST user programs.

* Send/Receive over "file like" link.

III-2 Example

Suppose that we, at UCLA, want to use NLS at SRI

a) Local arrangements

* Log in on local TTY to Sigma 7. We are now talking to the command level of the Sigma operating system.

* Select an user program to put in execut

We start up a program we previously wrote. It runs TTY and the transmission with SRI.

* Or select the standard UCLA communications program. This is the standard option for simple control of a remote HOST.

b) Connection to SRI

* Initiate link to remote HOST

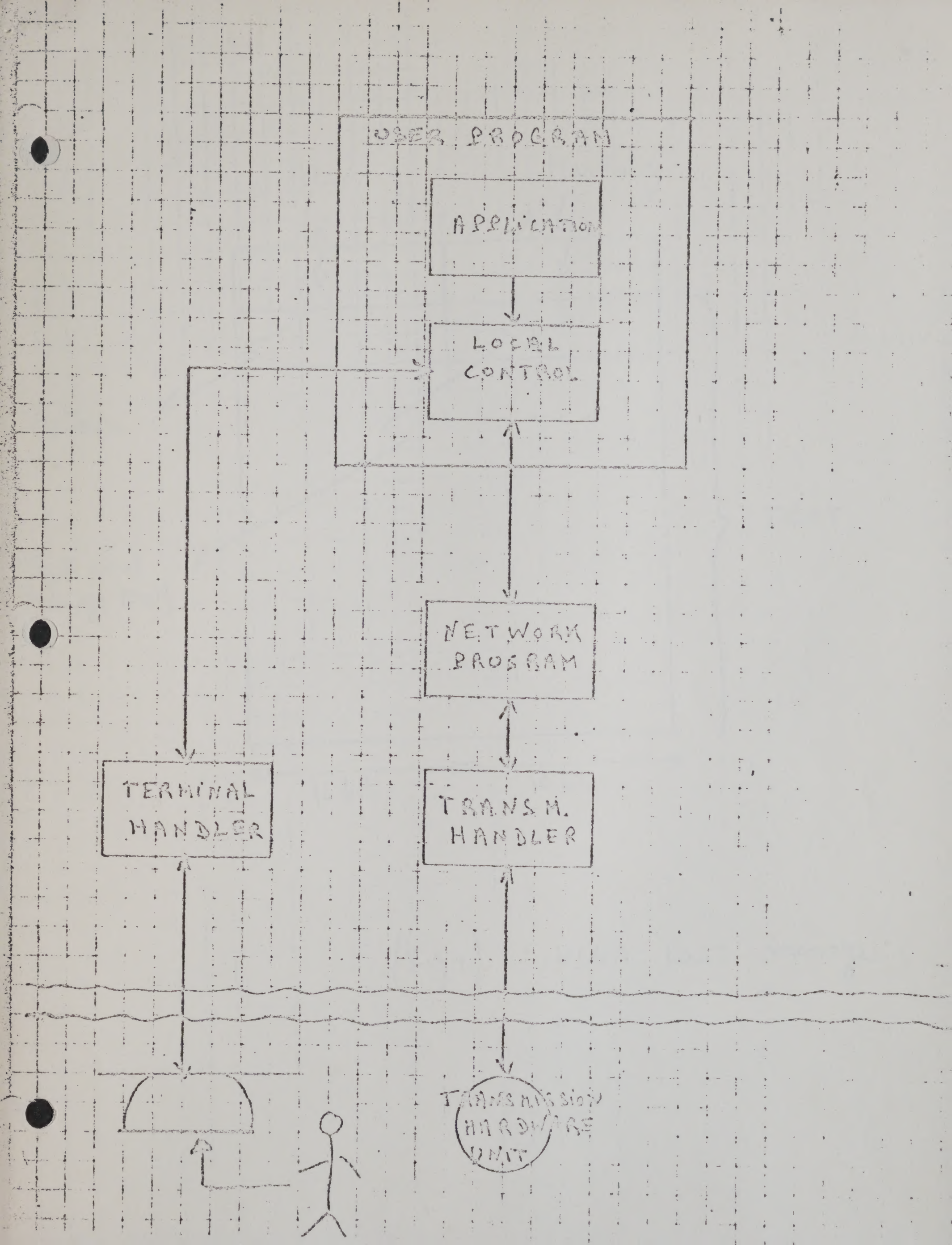
The previously selected program asks the UCLA Network program to initiate a link to SRI. The Network program:

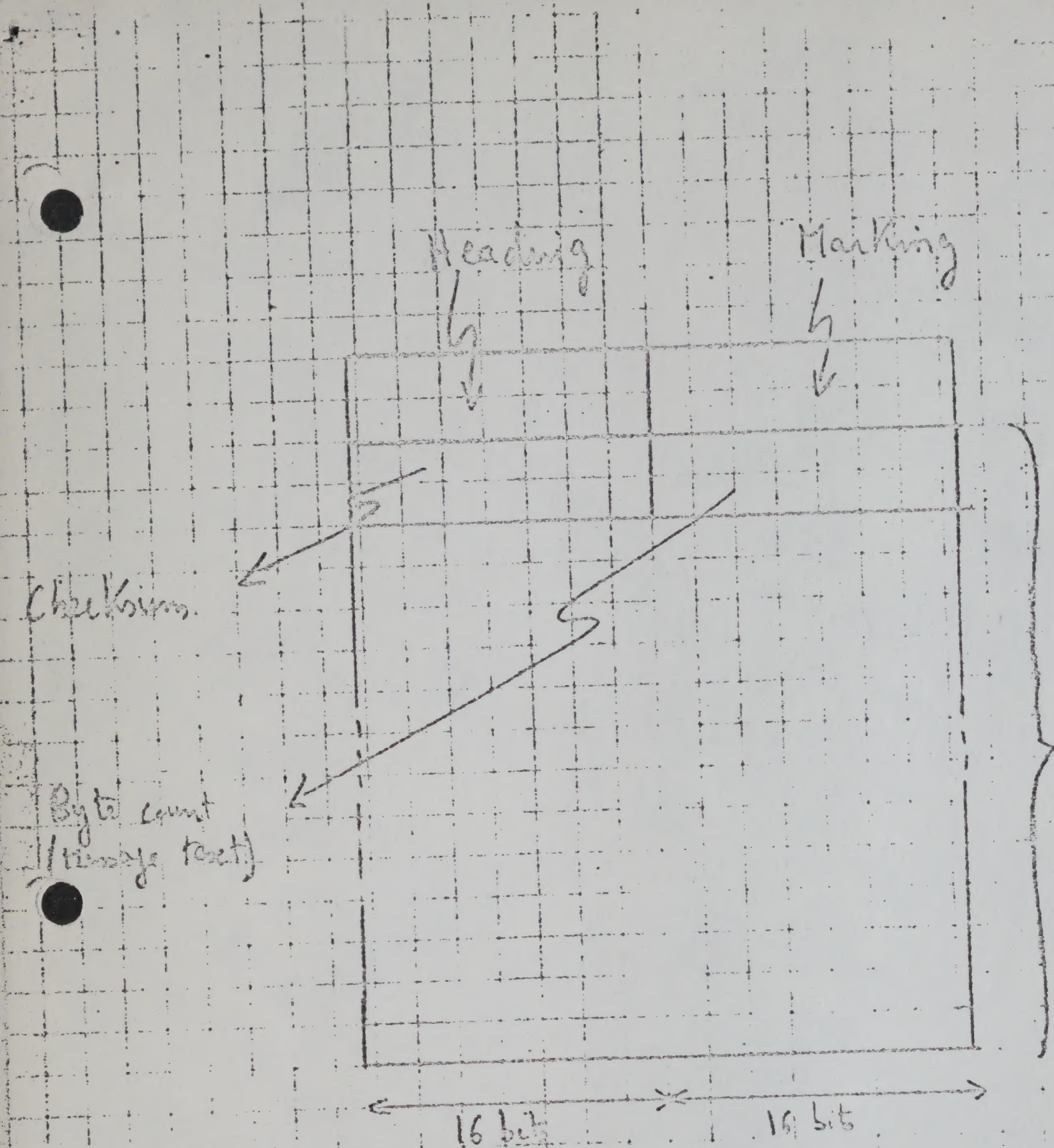
- Selects an open link e.g 25
- Sends a message to SRI over link 0 requesting connection on link 25.
- Waits for an acceptance from the SRI network program. This acceptance is in the form of another message over link 0.
- If it should happen that both SRI and UCLA try to initiate a connection over 25, the one with the higher priority will prevail. (This is extremely rare) We suggest that the priority be exactly the HOST identification number.
- This connection is teletype-like connection only a standard subset of ASCII characters is rejected or accepted.
- The connection is a "log-in" connection. The remote HOST expects its standard log-in sequence

* Log-in at SRI.
This may be done either by the UCLA user program if it knows how, or by the man at UCLA by typing the required sequence. We are now talking the command level of the SRI operating system.

Get user prog. at SRI with x' and x''

c) Request 'local control' program for SRI.
* The UCLA selected program sends a message over the link to the SRI user program. The message requests that SRI transmit to UCLA the 'local control' program which is written in the DEL language.
* We compile this program through a compiler.
* We turn control of the TTY link a terminal over the just compiled DEL program


USER PROGRAM
APPLICATION
LOCAL CONTROL
NETWORK PROGRAM
TERMINAL HANDLER
TRANSM. HANDLER
TRANSMISSION HARDWARE UNIT



(Fig 1) : UCLA Host message